Order PELECANIFORMES

Medium-sized to very large aquatic birds of marine and inland waters. Worldwide distribution. Six families all breeding in our region. Feed mainly on aquatic animals including fish, arthropods and molluscs. Take-off from water aided by hopping or kicking with both feet together, in synchrony with wing-beat. Totipalmate (four toes connected by three webs). Hind toe rather long and turned inwards. Claws of feet curved and strong to aid in clambering up cliffs and trees. Body-down evenly distributed on both pterylae and apteria. Contour-feathers without after shaft, except slightly developed in Fregatidae. Pair of oil glands rather large and external opening tufted. Upper mandible has complex rhamphotheca of three or four plates. Pair of salt-glands or nasal glands recessed into underside of frontal bone (not upper side as in other saltwater birds) (Schmidt-Nielson 1959; Siegel-Causey 1990). Salt-glands drain via ducts under rhamphotheca at tip of upper mandible. Moist throat-lining used for evaporative cooling aided by rapid gular-flutter of hyoid bones. Tongue rudimentary, but somewhat larger in Phaethontidae. Throat, oesophagus and stomach united in a distensible gullet. Undigested food remains are regurgitated. Only fluids pass pyloric sphincter.

Sexually dimorphic plumage only in Anhingidae and Fregatidae. Selection of nest-site and initiation of pair-formation by male, but in Pelecanidae female first leads several males in a male-selection (or persistence) chase as in ducks. Nest built by female with material brought to nest-site mainly by male. Copulation normally on nest-site. Both sexes take turns guarding nest-site, incubating eggs, and brooding and feeding chicks. Eggs unicoloured with chalky finish except for Phaethontidae. Webbed feet used to warm eggs. Chicks hatch naked (except in Phaethontidae) and blind. Later fully covered with down for several weeks. Newly hatched chicks take fluid food from tip of parental bill. Older chicks take partly digested food from parental gullet, except in Phaethontidae, in which parent inserts bill into gullet of chick. Chicks become independent usually within a few weeks after fledging and at fledging in gannets *Sula* spp. At nesting colonies severe loss of eggs and chicks may result from human disturbance, parents being forced off nests, so that eggs and chicks become cold or overheat or are taken by predators.

Anatomical and behavioural similarities suggest close phylogenetic affinities between Pelecaniformes and Ciconiiformes, which could perhaps be united. Cottam (1957) found skeletal characters that suggest that the Shoe-billed Stork *Balaeniceps rex*, only member of the African family Balaenicipitidae, ought to be in Pelecaniformes rather than Ciconiiformes. Linnaeus (1758) included all pelecaniform birds known to him, except those in *Phaethon*, in the genus *Pelecanus*, from which Brisson (1760) removed the genera *Sula*, *Anhinga*, *Phalacrocorax* and *Fregata*. Subsequently these genera became the bases of six families in the order Pelecaniformes, formerly known as the Steganopodes. Over the last 200 years there has been debate about whether *Phaethon* and even *Fregata* ought to be included, and whether *Anhinga* ought to be in the same family as *Phalacrocorax*. There is ample behavioural (van Tets 1965), osteological and palaeontological (Olson 1985) evidence to demonstrate that there are six distinct extant families in the Pelecaniformes.

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Family SULIDAE gannets and boobies

Large to fairly large seabirds, occurring in all oceans except n. North Pacific and s. Southern Oceans. Nine species in two groups: six boobies and three gannets. Though treated here, after Peters, in one genus, for a long time many authorities have proposed two genera: *Sula* (*s.s.*) for boobies and *Morus* for gannets. Recently a third genus *Papasula* has been recognized for the forest-booby *S. abbotti*. All are separated on behavioural and osteological characters such as distinctive hypotarsus and number of ossicles per sclerotic ring (Nelson 1978; Olson & Warheit 1988; van Tets *et al.* 1988). The family appears close to the ancestral stock that gave rise also to the Anhingidae, Phalacrocoracidae, Fregatidae and to the extinct Pelegornithidae (bony-toothed seabirds), Protoplotidae (slender volant divers) and Plotopteridae (robust flightless divers) (Olson 1977, 1985; van Tets 1965; van Tets *et al.* 1989).

Short thick neck; elongate body; long pointed wings, 11 primaries (p9 or p10 longest) and about 28 secondaries, diastataxic; wedge-shaped, medium-long tail with 12–16 rectrices. Sturdy cone-shaped bill, slightly decurved at tip; cutting edges serrated. Naked skin on gular and facial areas, more extensive in boobies so that eyes set well within bare areas and with thick fleshy eye-ring. Secondary external nares (Ewart 1881; Macdonald 1960). Ventral skin strongly pneumatic with large subcutaneous air-sacs, built for plunge-diving. Plumage, mostly white with black on wings. Some species with white, grey or brown morphs. Bare parts, often brightly coloured. Oil gland, feathered. Sexes similar except in colours of bare parts in some species. Juveniles differ from adults, reaching full adult plumage in 2–4 years. Stance upright, tilted slightly backwards; gait waddling. Diving almost vertical in gannets; at fairly low angle in boobies. Flight, alternate periods of flapping and gliding, often quite high above water. Swim well with head high and tail above water.

Distributed in all temperate and tropical oceans. Gannets are typical of temperate-zone seas and may reach tropics on migration; the three species, of which one breeds and one is a rare vagrant in our region, are allopatric. These are sometimes treated as subspecies of the Northern Gannet *S. bassana* but differ enough in size, distribution of black in wings and tail, length of throat-stripe and pattern on tarsus to be treated as separate species, composing a superspecies. Boobies (excluding Abbott's) are tropical and subtropical; five species, of which three breed in our region, in sympatry. The one species of forest-booby is now confined to Christmas I. (Ind.) but formerly was more widespread (Bourne 1976; Nelson 1974; Olson & Warheit 1988). Strictly marine, inshore and offshore rather than pelagic, except for some boobies, with rather aerial habits, tending to fly quite high. Plunge-dive for food, often spectacularly so when in feeding flocks. White plumage of most species conspicuous, even at considerable distance. Feed chiefly on fish, especially on shoaling species (gannets) or on flying fish (boobies). Migratory and dispersive; juvenile and immature birds may be more so than adults.

Monogamous pair-bond, often long-lasting and probably maintained only at nest-site. Defend nest-site territories. Pairs use same site year after year. Breed mainly in large dense colonies on islands and sometimes on mainland; on cliffs and stacks or on flat sandy cays. Usually nest on ground but *S. abbotti* is entirely arboreal. The Red-footed Booby *S. sula* also nests and roosts in bushes and trees and the Brown Booby *S. leucogaster* perches in trees and bushes but nests on ground. All other species roost and nest on ground. Various displays at breeding grounds for greeting, male-advertising and flight-intention such as sky-pointing, a precursor of various displays in other Pelecaniformes and related to the stretch-display of ardeids (van Tets 1965). Breeding annual and strictly seasonal in gannets; more protracted in boobies, in which it may be non-seasonal and less than annual in some species; in *S. abbotti*, if successful, only once every 2 years. Nests vary from mere shallow depressions on ground without material to substantial heaps of vegetation and debris cemented with guano or to simple stick-nests in trees. Both sexes build but male typically brings material. Density of nests in colonies closest in gannets; often quite dispersed or even solitary in boobies. Eggs, ovate, pale green, blue or white staining brown, with chalky coating. Clutch-size, 1–4, laid at intervals of about 5 days. Replacement laying after loss. Incubation starts with first egg; by both sexes in roughly equal shares; eggs incubated in feet; no brood-patch. Incubation period, 40–55 days. Eggshells left in nest or discarded. Hatching asynchronic. Young, altricial, nidicolous, downy. Cared for and fed by both parents, usually by incomplete regurgitation. Brooded continuously for 2–3 weeks, then guarded for as long as possible (boobies) or to fledging (gannets). If two chicks hatch from clutches of two, typically only one survives. Nestling period, 85–175 days, with great variation in boobies, depending on food supply. Age at maturity, 4–6 years.

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Sula capensis Cape Gannet

Dysporus capensis Lichtenstein, 1823, *Verzeich. Doublet. zool. Mus Berlin*: 86 — Cape of Good Hope.

Named specifically after the type-locality.

OTHER ENGLISH NAMES African or South African Gannet, Malagas(h).

MONOTYPIC

FIELD IDENTIFICATION Length 85–94 cm; wingspan 171–185 cm. Long-bodied, long-winged, mostly white seabird with spear-shaped bill and yellowish head. Similar to Australasian *S. serrator* and Northern *S. bassana* Gannets but distinguished by differing amount of black in wings and tail and, at close range, by length of gular stripe; distinguished from all smaller boobies by yellowish head. Sexes alike; no marked seasonal plumages. Juveniles and immatures with great variety of blackish, brownish and white mottled plumages, indistinguishable at a distance from same-aged birds of Australasian and Northern Gannets; distinguishable at close range by length of gular stripe.

DESCRIPTION ADULT. Like Australasian Gannet but most (89%) with wholly black tails (n=3682; Broekhuysen & Liversidge 1954); most others with two white outer tail-feathers on each side and thus more like tail-pattern of Australasian Gannet but perhaps never with symmetrical black-centred pattern of that species (Broekhuysen & Liversidge 1954). When close in good conditions, blackish gular stripe visible, 3–4 times longer than that of Australasian Gannet, from base of bill to throat. Iris, silvery cream, paler than in Australasian Gannet and may be better field character than length of gular stripe (Berruti 1988). JUVENILE, IMMATURE. Inseparable from Australasian Gannet, except for gular stripe at close quarters; a variety of brownish plumages from rather uniform brown in 1-year-olds, becoming with age more and more mottled with white, starting on lower body and working to head, neck, breast and wings (see Australasian Gannet). By end of second year, plumage white speckled with black, equivalent to late third-year or early fourth-year Northern Gannet.

SIMILAR SPECIES In our area, only Australasian Gannet, which see for discussion.

At sea, occur singly and in flocks of a few birds to thousands. Feed by day by plunging from 5–20 m, plummeting into water at steep angle with wings trailing behind, spearing fish from above; sometimes surface-seizing within surface schools of fish (Rand 1959); captured fish usually swallowed underwater, occasionally at surface. Flight and general behaviour as for Australasian Gannet and distinguished from albatrosses by more direct, actively flapping progress with less gliding and swooping, by generally smaller size and stiffer wings. *Karakara* calls given on alighting are lower-pitched than those of Australasian Gannet.

HABITAT Marine; adults generally in continental shelf waters off s. Africa within 50–100 km of land; few pelagic records in South Atlantic Ocean (Summerhayes *et al.* 1974; Crawford *et al.* 1983; Berruti 1987); largely confined to cold waters of Benguela and Agulhas currents. Many immatures spend first two years in tropical waters, mostly off w. Africa; inshore June–Aug. possibly farther offshore in summer (Broekhuysen *et al.* 1961; Nelson 1978).

Aerial foraging, 5–20 m above water. Most feed singly or in groups up to 50, rarely in flocks up to 500 or more. Follows trawlers into deeper waters; often associates with Common Dolphin *Delphinus delphis*.

DISTRIBUTION Endemic to s. Africa; coastal and offshore waters from Gulf of Guinea to Natal and s. Mozambique. Breeds on six islands off coast of South Africa and Namibia: Mercury, Ichaboe, Possession; Bird (Lambert Bay), Malagas, Bird (Algoa Bay); formerly bred three other islands (Crawford *et al.* 1983). Stragglers farther N; on w. coast, most n. record off w. Sahara 1966; on e. coast to Beira; seldom N of Natal; most n. record s. Kenya (Crawford *et al.* 1983). One collected May 1831 at Bass Rock, Scotland (MacGillivray 1852).

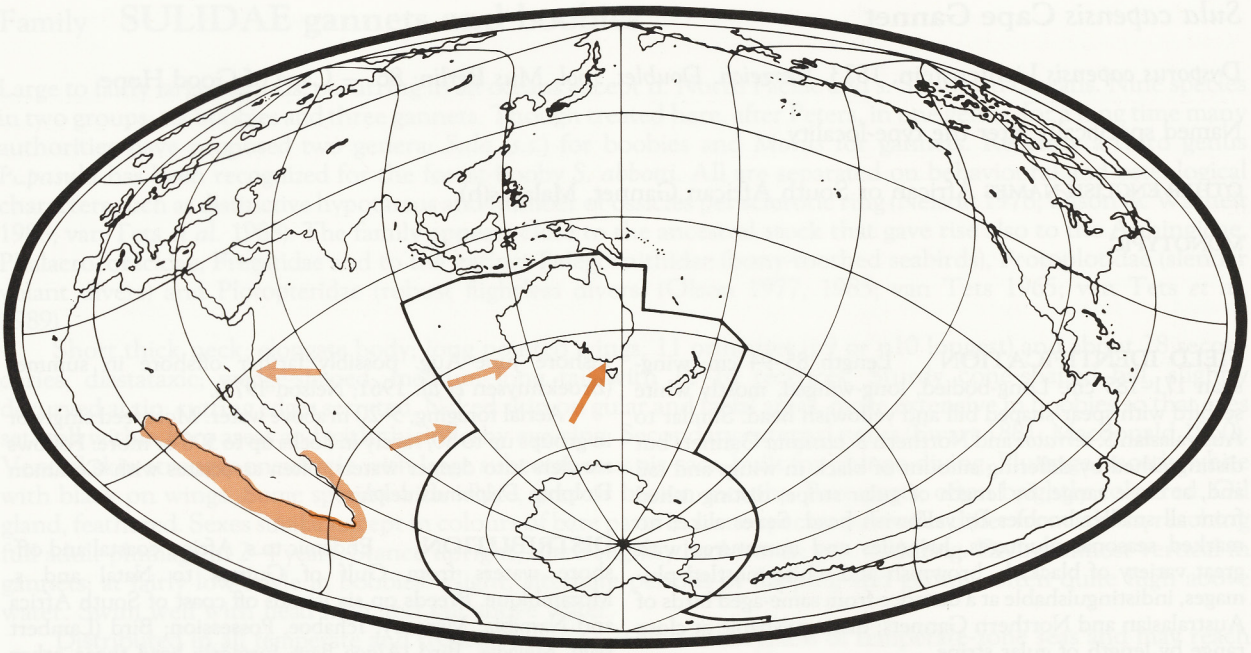
Most restricted range of any sulid except Abbott's Booby *S. abbotti*. Population declined from *c.* 166 200 pairs in 1956 (Rand 1959, 1963a,b; Nelson 1978) to *c.* 80 000 pairs in 1980 (Crawford *et al.* 1983) but decline halted, at least temporarily, in late-1980s (A. Berruti). Though fully protected, decline attributed to human interference through depletion of pelagic fish off s. Africa and Namibia, commercial collection of guano and intentional and accidental killing of birds (Crawford *et al.* 1983). Valuable as producer of guano (Cooper *et al.* 1984).

Accidental to Aust. waters. Single bird nesting with Australasian Gannets on Wedge Light, navigational beacon, Port Phillip Bay, Vic., 2 Jan. 1981 (Cameron 1981; Venn 1982) and every year since to 1988, except 1984 (Vic. Bird Reps 1982–85). Report of successful breeding between Cape and Australasian Gannets (Venn 1982) needs to be verified. South African banded bird caught on fishing line off C. Leeuwin, WA, 18 Oct. 1986 (Ross 1988); second observation when it (or another) attracted to fishing boat (S.R. Keeling). At Iles Amsterdam and St Paul, 14 sightings between Oct. and Feb.: 1979, 1980, 1981, 1984, 1985 (Harris 1982; Roux & Martinez 1987; J-C. Stahl).

Because Cape Gannets are so hard to distinguish from Australasian Gannets unless at close range, perhaps they are overlooked at sea, especially in WA waters, and may be less unusual in our region than appears.

MOVEMENTS Partially migratory. Most records N of normal range are immature birds (Broekhuysen & Liversidge 1954; Crawford *et al.* 1983).

ADULTS When breeding generally within 200 km (alongshore) of colony (Berruti 1987). Most leave colonies late May, returning by late Aug.; some present throughout year, however colonies off Namibia abandoned during winter. Most stay in s. African waters, generally within 500 km of



breeding grounds (Brown *et al.* 1982). Move mainly along sw. and w. African coasts; occasionally along e. coast to Delagoa Bay, Mozambique.

JUVENILE, IMMATURE Fledging Mar.–May. Most leave s. African waters by May; migrate N, mostly to Angola and Gulf of Guinea where they arrive in June; smaller numbers to Mozambique. Most return to colony in third or fourth year. At least 16% stay in tropics during the breeding season following fledging.

BANDING 76% recoveries farther than 1460 km from colonies, 15% farther than 4000 km (Broekhuysen *et al.* 1961; Nelson 1978; Brown *et al.* 1982; Crawford *et al.* 1983). At Ile Amsterdam all records were adults between Oct. and early Mar.; wintering destination unknown (Harris 1982; Roux & Martinez 1987; J-C. Stahl). Records in s. Indian Ocean apparently more frequent in recent years.

Bird banded Bird I. (Algoa Bay), South Africa, 17 Feb. 1985 as fledgeling, captured off C. Leeuwin, WA, 18 Oct. 1986; distance travelled: 7860 km; time: 20 months (Ross 1988).

PLUMAGES

ADULT Sexes similar. Adult plumage attained in 3–4 years (Jarvis 1972; Nelson 1978). Differences between breeding and non-breeding plumages slight; buff on crown more intense in breeding season. HEAD AND NECK. Frons and narrow rim of feathers extending from crown to gape, adjoining facial skin, white. Facial skin, naked, extending as sharp point to gape. Crown to hindneck, buff (124) merging to pale horn (92) at hindneck. Rest of neck, including outer chin and throat, white; 13–19 mm long, narrow strip of bare skin, gular streak, extends beyond gular pouch to mid-neck. Gular streak (live birds) in males 169 (1.07; 152–189; 10); females 156 (0.97; 134–169; 10) (Jarvis 1972). UPPERPARTS. Mantle, back, rump and upper tail-coverts white. TAIL. Rectrices, dark brown (121). Varying amount of white in tail; 11% of birds older than one year had some (n=3682; Broekhuysen & Liversidge 1954). UPPERWING. Scapulars, humerals and tertiaries, white. Primaries and secondaries dark brown (121); reduced pale base of inner webs. Rachis of primaries cream (54) basally merging to sepia (119) at tip. Rest of upperwing, apart from alula, white. Alula dark brown (121); prominent over white marginal coverts. UNDERPARTS. Entirely white. UNDERWING. All coverts, and axillaries, white.

DOWNY YOUNG, JUVENILE, IMMATURE Plumages not seen in Aust. Successful inter-breeding between Cape and Australasian Gannets not verified, but nestling said to be similar to Australasian Gannet (Venn 1982). Immature plumage involves gradual whitening, as in Australasian Gannet. Juvenile plumage inseparable from Northern Gannet. For descriptions and details of development of downy young, juvenile and immature plumages, see Rand (1959), Nelson (1978) and Brown *et al.* (1982). See also account of juvenile for Northern Gannets in BWP.

ABERRANT PLUMAGES Albinism recorded (Nelson 1978).

BARE PARTS

ADULT Similar in breeding and non-breeding; maximum intensity of colour during breeding season. Iris, pearl-grey (81) with pale-horn (92) tinge. Eye-ring, pale blue (168D). Facial skin, black (82). Bill, pale grey (86) with pearl-grey (81) tone; gape and ridge between culminicorn and latericorn, black (82). Gular pouch and gular streak, black (82). Legs and feet, dark grey (83); broad light-green (162D) lines extend along front of tarsus and along ridge of each toe.

DOWNY YOUNG, JUVENILE, IMMATURE Not seen in Aust. For details of bare parts, see references in Plumages.

MOULTS

Undescribed in Aust.

ADULT Staffelmauser. Insufficiently described in Africa. Up to three generations of moult in series; moult in Dec., Jan. to June–July at which time completed. Feather replacement can occur during incubation (Rand 1959). Details of primary moult unknown, together with timing and replacement rate of each primary. Moult similar to Northern Gannet (Nelson 1978).

MEASUREMENTS (1) Live birds; methods unknown (Rand 1959). (2) Live birds; methods unknown (Jarvis 1972).

		MALES	FEMALES
WING	(1)	480 (450–510; 20)	— (477–510; 16)
BILL	(1)	92 (88–97; 43)	91 (91–97; 51)
	(2)	93.6 (0.29; 90–100; 10)	91.4 (85–100; 10)
TAIL	(1)	189 (180–205; 16)	191 (191–206; 30)

Males slightly larger than females. For additional measurements, see Alexander (1928) and Witherby *et al.* (1943). Details of growth rates of chicks in Rand (1959), Jarvis (1971, 1974).

WEIGHTS Live birds; after (1) Rand (1959); (2) Jarvis (1971):

	MALES	FEMALES
(1)	2665 (2523–3005; 55)	2608 (2240–3291; 61)
(2)	2618 (2296–2920; 61)	2669 (2381–3118; 53)

Undescribed in Aust. See Rand (1959), for monthly series of adult weights, from Apr. to Dec., of birds caught at sea. Rand (1959) gives mean weights: at start of breeding, males 2722 (—; 23); during incubation, males 2634 (—; 10), females 2679 (—; 10); after chick rearing, males 2579 (—; 22), females 2605 (—; 20). Males and females about the same weight; females showing greater variation (Rand 1959). Loss of weight apparently similar to Australasian Gannet (*q.v.*). Details of chick weights in Jarvis (1971, 1974).

STRUCTURE Wing, long and broad. Eleven primaries, p8 longest, p10 p9 p8 p7 p6 p5 p4 p3 p2 p1 p11 minute. Tail, wedge-shaped; 12 rectrices, t1 longest, t6 shortest. Bill longer than head, conical, high at base, tapering towards tip, where slightly curved. Backward serrations on upper and lower mandibles. Upper mandible composed of culminicorn and laterocorn, with secondary external nostril near gape. No external nostrils. Tarsus, short and stout. Claws strongly curved; middle longest, pectinated.

SEXING, AGEING Adults on measurements and length of gular streak (see above). Age categories on plumage and bare parts (see above). Adults breed when 2–3 years old (Rand 1959; Jarvis 1972).

GEOGRAPHICAL VARIATION None known. Often treated as full species in genus *Sula* (*Sula capensis*) or trinomially under *Sula bassana* (*S. bassana capensis*). Here, treated as one of three allospecies (*bassana, capensis, serrator*) forming a superspecies.

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Australasian Gannet *Sula serrator*
1. Adult
2. Immature
3. Juvenile
4. Downy young
5. Adult, dorsal
6. Adult, ventral
7. Immature, dorsal
8. Juvenile, ventral

Cape Gannet *Sula capensis*
9. Adult
10. Adult, dorsal